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SIMULATION OF SHIP MANAGEMENT IN PREPARATION OF PROFESSIONALS FOR INLAND NAVIGATION

Increased movement of cargo and passenger ships requires increased demands on the leaders of vessels, their qualifications and professional skills. Qualified leader of river vessels must develop their theoretical knowledge and practical experience of several years to handle the various sections of the shipping route. As an effective alternative appears to use the simulator motion of the vessel for the purpose of training and career development of practical skills leaders vessels, which would simulate navigation in all conditions and all seasons.

1. INTRODUCTION

Current modern trend of globalisation determines conditions of development almost in all fields of human society. One of the most important fields is of course transportation. Constituent countries unite into bigger economical and political unions what is a consequence of higher necessity of (goods, persons) transport and also a need of optimal transport utilisation.

At the various international meetings relating to the further development of cooperation among the member countries of the Economic Commission for Europe (ECE) in the context of the AGN Agreement, attention is always given to the important role of inland navigation and river-sea navigation in developing the Pan-European transport market.

A number of studies suggest that the establishment of efficient coastal routes would have the following benefits:

- Transfer of foreign-trade freight traffic to river shipping;
- Completing the circle, currently broken in places, of category E waterways, linking the deep waterways of the European part of Russia to the network of European waterways of international significance and establishing a pan-European ring of trunk waterways around the whole of Europe;
- More effective use of the Rhine-Main-Danube trans-European trunk waterway and the pan-European transport corridors;

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- Rendering transport operations more environmentally friendly and economically advantageous, since freight will be conveyed by inland waterways directly into the hinterland;
- Use of new transport and fleet management technologies and closer cooperation among the member countries of ECE in these matters;
- Promoting inland navigation and river-sea navigation on the waterways of France, Portugal, Spain and Italy.

Inland waterway transport in Eastern Europe is now probably less affected by modernization and innovation as the other transport modes. This situation could change in the near future. One of the objectives of the EU, expressed in the adoption of an integrated European Action Program NAIADES, is to support new technologies and a fleet modernization. It will not increases only the competitiveness on the market, but also a need of operators increase qualification, and thus the necessity of finding the best training method of crew members. IMO (International Maritime Organization) United Nations specialized agency for maritime transport solves this problem already for several years and through the development of education in the field of STCW (International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 78/95), has trying to apply the most advanced forms of training. STCW convention provides training and tests for specific certificates in three forms, by:

- Laboratory equipment;
- Real time simulators with a high degree accuracy;
- Real vessels.

There is no doubt that the cheapest and safest form of training and testing, is use of simulators. Moreover, especially graphic simulators equipped with the software can simulate different situations, where training in real environment would be problematic or would jeopardize the security.

The current level of information technology allows high level of real conditions simulation. The disadvantage is they are expensive. One of the way how to minimize the high cost, is to build a scalable simulator, for example simulator with the possibility to expand from a simpler version to the more complex, using a previous installation of hardware and software. In this way the simulator can make resources for its own modernization.[1, 3, 4]

2. TRAINING SIMULATOR "SHIPMASTER"

The first generation of simulator "Shipmaster" designed for river boat control, based on virtual reality, belongs to the category of full-scope training simulators. In its implementation were used modern information technologies in the field of personal training, 3D graphics and virtual reality simulation, physical processes and the operation of technological systems in real time. The device was designed to use standard PC-type computers running on Windows XP. The Shipmaster was created in collaboration VUJE Trnava, a. s., which set up the complete hardware equipment and software development. On the realization participated also Štátna plavebná správa.

2.1 Architecture of simulator

In terms of hardware, the training simulator consists of five components:

- Wheelhouse desks model (Muflon tugboat), including the most important elements affecting the operation of a pushed convoy (joystick for rudder positioning ±35°, control lever –power input of both engines (left and right), start button for engines, strat button for hydraulic pump, control buttons for ship horn, and lights, etc.);
- Simulator application server (communication module, math module, controller of I/O electronics); graphic server, which generates a virtual scene and treats all interactions with objects in the scene;
- LCD projector with 1027x768 resolution and one projecting canvas for rear projection with dimensions 229x305 cm;
- PC "mentoring console" for management training scenarios.

Fig. 1 The view on the display screen of the simulator

In terms of software, the system is equipped with:

- A mathematical simulation module for tugboat Mouflon in a pushed convoy navigation;
- Application software for generation of virtual scenes, including modules for treatment; interaction with objects on the scene;
- Communication module for sharing simulation database in real-time;
- Software for state control scanning and signalization management on the wheelhouse body;
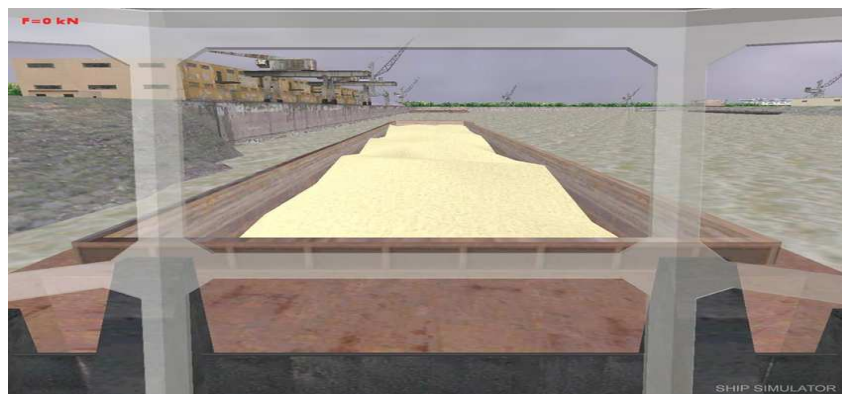- Software for training instructor.

Fig.2 Port of Bratislava

Simulated vessel is universal pushed convoy 1tugboat + 1barge, but it is possible to extend this scheme to the scheme of 1Tugboat + 4 barges.

Math code simulates the movement of the scheme in three degrees of freedom (VX - ahead speed of the vessel, VY - transverse speed of the vessel, CO - the angular velocity of rotation about the vertical axis of the vessel). Code includes a simulation of bounces from objects in the virtual scene, the influence of river flow and various options for mooring the ship (bow to starboard or port side, stern the starboard or port). The simulator allows navigation training in two locations: waterway model traffic on the Danube River from km 1864 to km 1873 (section from bridge Lafranconi all the way to behind the Port bridge) and a waterway model around the locks in Gabčíkovo.

Fig. 3 The entrance to the lock chambers in Gabčíkovo

2.2 Options of simulation

The training simulator allows to practice standard navigational maneuvers: navigation trough lock, downstream, upstream navigation, mooring at the state pontoon, navigation trough the port, exit port pool to the main stream of Danube; meeting with the passing vessel, overtaking, navigation under a bridge.

The simulator allows also realize picked training strategy:

- Exploring learning, trainee has an opportunity to become acquainted with characteristic features of navigational routes: navigational signs, traffic lights, bridge objects, significant buildings, river flow, traffic;
- Learning by doing, acquisition of work procedure for practical implementation of activities – a trainee has the opportunity to acquire basic routine ships operation, which navigates in different conditions: in steady water, stream, in a lock, etc;
- Supervised learning: a trainee may attend a training trip accompanied by instructor during the voyage;
- Timezone learning: learning, in which time-consuming operations are deliberately accelerated, so the continuity of following individual operations could be highlighted – a trainee has the opportunity to navigate monotonous stretches of the way at the accelerated tempo (set by instructor), to be able to concentrate on training in critical sections of the waterway.

Training simulator in its range covers the most objectives of teaching practice in training pilots and captains. It is also suitable for checking license applicants.[2, 5, 6]

3. CONCLUSION

Since 2008, the simulator is installed at the Department of waterway at University of Žilina. These days finished the first phase of project (Completion of a prototype simulator) related to the preparation of new navigation scenarios for virtual application programs compilations. Development of a new prototype simulator should contribute to the integration of the best research and teaching methods, which increases the quality of the teaching process and the degree of cooperation research-development institutions with social and economic practices.

4. REFERENCES

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